Equivalent Ratios

Use What You Know

In Lessons 1 and 2, you learned about ratios. Take a look at this problem.

Mr. West uses this recipe to make a batch of soup. He often doubles or triples the recipe and freezes some of the soup. What ratio of cups of stock to batches of soup should Mr. West use to make 1, 2, and 3 batches of soup?

RECIPE
POTATO SOUP

Ingredients
1 pound potatoes
2 leeks
2 cups chopped onion
4 cups stock
1 tablespoon olive oil
1 teaspoon Italian seasoning

Use math you already know to solve the problem.

a. How many cups of stock are needed to double the recipe? Explain.

b. How many cups of stock are needed to triple the recipe? Explain.

c. Write the ratios of cups of stock to batches of soup for 1, 2, and 3 batches of soup.

d. Write the related rate and unit rate for each ratio you wrote in Part c. What do you notice about all of the rates and unit rates?

Find Out More

The ratios of cups of stock to batches of soup that you wrote in *Use What You Know* are **equivalent ratios**. They all have the same related rate and unit rate. Each ratio of cups of stock to batches of soup has a unit rate of 4. The first quantity (cups of stock) in each ratio is 4 times the second quantity (batches of soup).

You can make a table to show other equivalent ratios.

Cups of Stock	**4**	8	12	16	20	24	28
Batches of Soup	**1**	2	3	4	5	6	7

If you know a ratio, you can make a table with as many equivalent ratios as you want.

In the problem on the previous page, the ratio that was given was a rate: **4 cups of stock** to **1 batch of soup**. Many problems give a ratio that is not expressed as a rate.

A caterer prepares fruit bowls for a luncheon. Each bowl has **8 grapes** for every **3 strawberries**.

	8×1	8×2	8×3	8×4	8×5
Number of Grapes	**8**	16	24	32	40
Number of Strawberries	**3**	6	9	12	15
	3×1	3×2	3×3	3×4	3×5

The ratio of grapes to strawberries in each fruit bowl is **8 to 3**. You can write other ratios equivalent to 8 to 3 using multiplication.

Reflect

1 How can you write equivalent ratios?

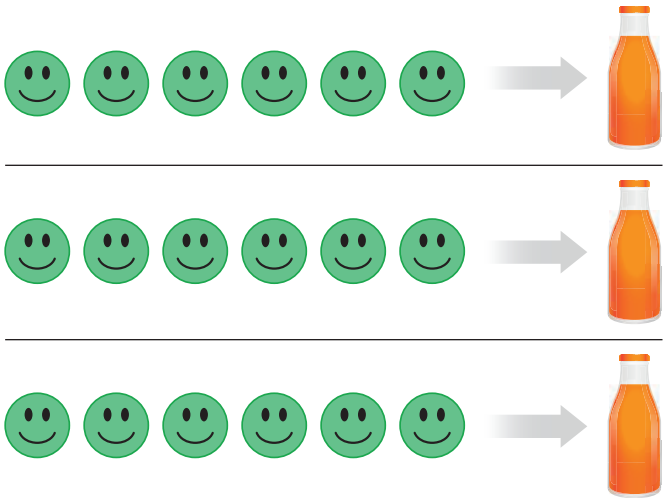
Learn About Showing Equivalent Ratios

Read the problem below. Then explore different ways to show equivalent ratios.

A cafeteria worker knows that it takes 3 bottles of juice to serve a table of 18 students. How many bottles of juice are needed for 24 students? How many bottles of juice are needed for 42 students?

Picture It

You can draw a diagram to represent a ratio of 18 students to 3 bottles of juice.



Model It

You can also make a table to show ratios of the number of students to the number of bottles of juice.

Number of Students	6	12	18				
Bottles of Juice	1	2	3	4	5	6	7

Connect It Now you will use the diagram and the table to solve the problem.

2 What is the ratio of the number of students to the number of bottles of juice?

3 What is the related rate for this ratio? Explain how the diagram represents this.

4 Look at the table. What is the unit rate? Tell how you know.

5 Use the unit rate to complete the table. How many bottles are needed for 24 and 42 students?

6 How do you use a table to show equivalent ratios?

Try It Use what you learned to solve these problems. Show your work on a separate sheet of paper.

7 Mikaela travels 15 blocks on her skateboard in 5 minutes. At this speed, how many blocks can she travel on her skateboard in 12 minutes?

8 A seamstress uses 12 yards of fabric to make 3 costumes for students in the chorus. How many yards will she need to make costumes for all 25 students in the chorus?

Learn About Graphing Equivalent Ratios

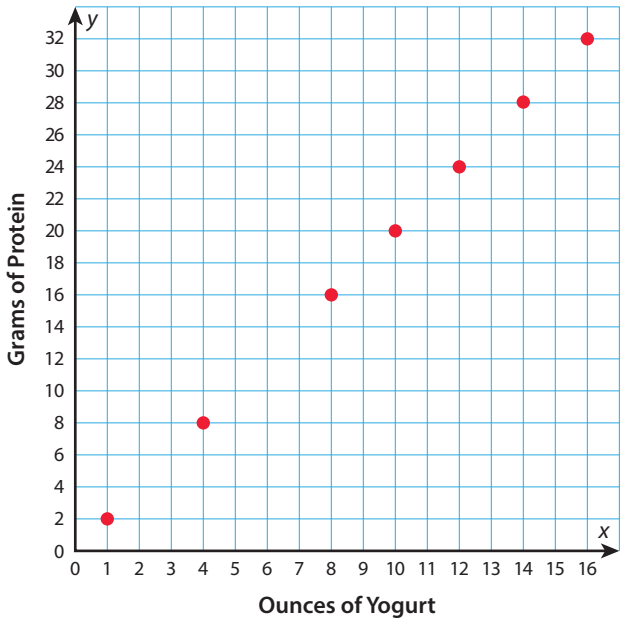
Read the problem below. Then explore different ways to show equivalent ratios.

A 4-ounce serving of yogurt has 8 grams of protein. How many grams of protein are in a 10-ounce serving? How many grams of protein are in the whole 16-ounce container of yogurt?

Model It You can use a table to show equivalent ratios.

Ounces of Yogurt	1	**4**	8	10	12	14	16
Grams of Protein	2	**8**	16	20	24	28	32

Graph It You can plot the ordered pairs on the coordinate plane.



Connect It

Now you will explore how to use the table and graph to find equivalent ratios.

9 What is the ratio of ounces of yogurt to grams of protein?

10 Look at the table. How many grams of protein are in 1 ounce of yogurt?

11 Each point on the graph shows an ordered pair from the table. Fill in the blanks to show these ordered pairs.

(1,____) (4, 8) (10,____) (16,____)

12 How are the numbers in each ordered pair related?

13 The ordered pair (10, 20) means 10 ounces of yogurt to ____ grams of protein.

The ordered pair (16, 32) means ____ ounces of yogurt to ____ grams of protein.

14 The table and graph show equivalent ratios. How are they similar? How are they different?

Try It

Use what you just learned to solve these problems. Show your work on a separate sheet of paper.

15 On in-line skates, Bradley skates 4 miles in 20 minutes. At this speed, how long would it take him to skate the entire length of a 12-mile bike path?

16 The cost of 5 team sweatshirts is $90. At this price, how much would it cost to buy sweatshirts for a whole team of 15 players?

Practice Finding Equivalent Ratios

Study the example below. Then solve problems 17–19.

Example

Jake made hummingbird nectar by mixing 8 cups of water with 2 cups of sugar. Ally used 9 cups of water and 3 cups of sugar. Which recipe is more sugary? Explain why.

Look at how you could show your work using tables.

Jake's Recipe

Cups of water	4	8
Cups of sugar	1	2

Ally's Recipe

Cups of water	3	9
Cups of sugar	1	3

Look at the ratios that compare the cups of water to 1 cup of sugar.
Ally's recipe has a ratio of 3 cups of water to 1 cup of sugar.
Jake's recipe has a ratio of 4 cups of water to 1 cup of sugar.

Solution Since Ally's recipe has less water for the same amount of sugar, her recipe is more sugary.

The student made tables of equivalent ratios for Jake's recipe and Ally's recipe. You can compare the ratios.

Pair/Share
How could you use division to solve the problem?

17 Mrs. Silva orders 5 pizzas for every 20 students working on the campus clean-up. How many pizzas should she order if 36 students participate? How many pizzas should she order if 48 students participate?

Show your work.

Solution _____

What is the ratio of students to pizzas?

Pair/Share
How would the problem change if Mrs. Silva orders 6 pizzas for 20 students?

18 David wants to fill his backyard swimming pool. His garden hose delivers 40 gallons in 5 minutes. How many gallons of water will be in the pool after 20 minutes? After 1 hour?

Show your work.

How many minutes are in 1 hour?

Pair/Share

How could you use the unit rate to solve the problem?

Solution _____

19 Coach McCarthy bought 6 soccer balls for $150. Which table correctly shows equivalent ratios for this cost?

What is the relationship between the cost and the number of soccer balls?

A

Number of Balls	1	2	3	4	5	6
Cost	$0	$30	$60	$90	$120	$150

B

Number of Balls	1	2	3	4	5	6
Cost	$25	$50	$75	$100	$125	$150

C

Number of Balls	1	2	3	4	5	6
Cost	$20	$40	$60	$80	$100	$150

D

Number of Balls	1	2	3	4	5	6
Cost	$120	$126	$132	$138	$144	$150

Kristin chose **C** as the correct answer. How did she get this answer?

_____

_____

_____

_____

Pair/Share

How can you use division to find which table shows equivalent ratios?

Practice Finding Equivalent Ratios

Solve the problems.

1 Which table shows equivalent ratios?

A

Number of Raisins	1	2	3	4	5	6
Total Calories	5	6	7	8	9	10

B

Number of Raisins	1	2	3	4	5	6
Total Calories	5	7	8	9	10	11

C

Number of Raisins	1	2	3	4	5	6
Total Calories	5	10	15	20	25	30

D

Number of Raisins	1	2	3	4	5	6
Total Calories	5	12	21	32	45	60

2 The table shows the calories in different numbers of small tangerines. Which of the following expressions show a way to find the number of calories in 10 tangerines? Circle all that apply.

Tangerines	2	4	6	8
Calories	80	160	240	320

A 10×20

B 10×40

C $80 + 320$

D $10 + 40$

3 Mrs. Baca uses a phone card to call her relatives in Colombia. It costs her 45 cents to talk for 15 minutes. Choose *True* or *False* for each statement.

a. For 75 cents, Mrs. Baca can talk for 3 minutes. ☐ True ☐ False

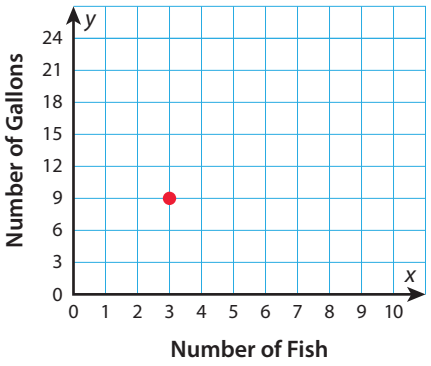
b. The rate is 3 cents per minute. ☐ True ☐ False

c. The rate can be represented by the ratio 45:15. ☐ True ☐ False

d. Divide 75 by 15 to find the number of minutes Mrs. Baca can talk. ☐ True ☐ False

4 Christina wants to buy some miniature goldfish. She reads that a 9-gallon aquarium is the right size for 3 miniature goldfish. The graph represents this relationship.

Which ordered pairs show equivalent ratios that would also be on the graph? Select all that apply.



A (6, 18)

B (6, 12)

C (4, 10)

D (1, 3)

5 Gloria rides a bike 8 miles in 40 minutes. Nanette rides a bike 5 miles in 30 minutes. If they continue to ride at those speeds, who will bike the farthest in 1 hour? How much farther?

Show your work.

6 One recipe for cereal bars uses 5 cups of cereal and $2\frac{1}{2}$ cups of nuts. A different recipe uses 3 cups of cereal and 1 cup of nuts. Which recipe is more nutty?

Show your work.

Self Check **Go back and see what you can check off on the Self Check on page 1.**